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(71)Applicant : INTER METALLICS KK

(72)Inventor : SAGAWA MASATO
WATANABE HIROSHI
SHIRAI HIROO

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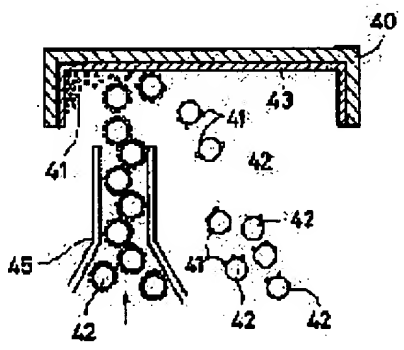
(54) ELECTROMAGNETIC SHIELDING FILM

(57)Abstract:

PURPOSE: To obtain an electromagnetic shielding film excellent in shielding properties by a method wherein the shielding film is composed of a compacted layer formed of a skeletal structure made of conductive material powder and resin partially filled into voids inside the skeletal structure and a lower resin layer.

CONSTITUTION: Thermosetting or thermoplastic resin and metal or allay powder with electrical conductivity and ferromagnetism required for electromagnetic shielding are used, uncured resin and other adhesive material are previously attached to the surface of film forming medium such as steel balls 42, and the steel balls 42 where powder 41 adheres are ejected out from a nozzle 45. An uncured resin layer 43 is formed on the inner side of a case 40, and when the steel balls 42 impinge against the resin layer 43, the powder 41 is caught by the resin layer 43 and intruded into it, and then the steel balls 42 are made to impinge successively against the resin layer 43. Therefore, powder 41 is more intruded into the resin layer 43, compressed to be enhanced in density, and comes into area contact with each other for the formation of a film of skeletal structure, the film is coated with a plating protective film, and thus an electromagnetic shielding film excellent in shielding properties and adhesion can be obtained.



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CLAIMS

[Claim(s)]
[Claim 1] The electromagnetic-shielding film characterized by the bird clapper from the fine-particles compression layer with which the aforementioned conductive coat had the skeletal structure which consisted of fine particles of the aforementioned conductive matter in the electromagnetic-shielding film of the conductive matter which consists of the above coat further, and the resin was filled up into a part of the opening [at least], and the resin layer of the aforementioned fine-particles compression layer bottom.
[Claim 2] The electromagnetic-shielding film according to claim 1 characterized by wearing the front face of the aforementioned electromagnetic-shielding coat by the protection coat.
[Claim 3] The electromagnetic-shielding film according to claim 2 characterized by the aforementioned protection coat being a conductive resin paint film or a conductive organic coat.
[Claim 4] The electromagnetic-shielding film according to claim 2 with which the aforementioned protective film is characterized by the bird clapper from a metal or an alloy deposit.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the coat which carries out electromagnetic shielding of an internal fixed field or internal fixed space by wearing all or a part of superficies of an electrical machinery and apparatus and an electrical part, and/or insides.
[0002] By covering space with the generation source of an electromagnetic wave with an electric conduction object or a ferromagnetic, using an operation of electrostatic shielding or electric wave absorption of a ferromagnetic, an electromagnetic wave invades from the exterior into space, or electromagnetic shielding prevents that the electromagnetic wave conversely generated from the interior of space is revealed to the exterior. Composition and the invasion of magnetic flux to the interior of space are prevented in a magnetic circuit so that a ferromagnetic may enclose the space of goods. This is especially one of the electromagnetic shielding, and is called magnetic shielding.
[0003] Electromagnetic shielding is electromagnetic wave disturbance (Electro Magnetic Interference, EMI) generated from an electronic circuitry during an electronic equipment operation recently although given and used for a building, an antenna cable, etc. for many years for an electromagnetic interference, invasion prevention of jamming, etc. It has been a big problem.
[0004]
[Description of the Prior Art] As the electromagnetic-shielding method for such an equipment, the following technology is well-known.
[0005] A metal plate constitutes the case of devices, such as a metal shield computer and a word processor, and an electromagnetic-shielding function is given. Although the cover performance is most excellent, this has the fault that a weight increases and is not used for small lightweight devices, such as a note word processor, a personal computer, etc. with which the quantity of production is extended in recent years, at all.
[0006] Vehicles, such as an acrylic and an urethane system resin, are made to distribute conductive fillers, such as conductive paints Cu, nickel, and Ag, this is applied to the inside or superficies of a plastics case, and a substrate, and a conductive coat is obtained. The spray for obtaining a uniform coat to the below-mentioned plating, although it is cheap in price cannot raise especially the amount of a difficult thing and a conductive filler more than 40 volume %, but there is a fault, like a shield performance is inferior compared with plating etc. Moreover, the rate of application is as bad as about 50%, and it is also 1 ** in question that many of expensive paints become futility.
[0007] Electroless plating Cu and nickel coat are made to form in a case front face by the electroless-plating method. Although coats, such as Cu and nickel, have a very high shield performance, as for high cost, control of bath, thickness, pinhole control, etc. also start waste fluid processing difficult again. Furthermore, the adhesion force of a plating film is small and tends to peel. Especially, depending on the quality of the material of plastics, the adhesion force of a plating film is too small, and it may be unable to galvanize. (For example, the kind of plastics which polyurethane, a polycarbonate, etc. cannot carry out electroless plating, but can be used is restricted.) Moreover, even if plating is possible, in order to raise the adhesion force, the butadiene to ABS plastics etc. needs to add a special additive to plastics, or needs to damage a front face chemically and physically with etching, sandblasting, etc. In addition, since a plating film is attached also to the superficies of a case, although it is necessary to carry out makeup paint, the paint with a sufficient plating side and sufficient affinity is restricted very much, and, moreover, its price is high. Although makeup paint is unnecessary if a plating film is attached only to an inside, it is necessary to mask superficies at the time of electroless plating. These [all] cause cost quantity.
[0008] Vacuum evaporationo film aluminum vacuum evaporationo is mainly used. Although there is also no problem of pollution like plating and it is more powerful than conductive coating material since it is dry process, the inside of

the hole where the dependency of the thickness to the angle to the source of vacuum evaporationo is large, and deep etc. sticks, the surroundings are bad, and thickness is uneven, and the adhesion force is also bad. It is batch processing fundamentally, and especially when there are few 1 time of throughputs, it is also one of the troubles to become cost quantity.

[0009] A conductive compound (plastics)

Cu fiber, aluminum flakes, and stainless steel fiber are made into a filler, a case is constituted from a conductive compound which mixed or wove in and made this in plastics, an electromagnetic-shielding performance is given to the case itself, and it has the advantage in which it is not necessary to make a conductive coat form later. The pattern of a filler comes floating on the front face of the compound which the fault fabricated, and appearance is the point that makeup paint is bad needed.

[0010]

[Problem(s) to be Solved by the Invention] The conventional electromagnetic-shielding film did not have that with which simplicity [preliminary processing of fitness, (c) waste fluid processing needlessness, and (d) coat formation] and a (e) coat are attached by (b) lightweight and the (b) shield performance, and fitness and (**) appearance are [surroundings nature] satisfied of all fitness etc. as mentioned above. this invention offers the electromagnetic-shielding film with which can be satisfied of these all.

[0011]

[Means for Solving the Problem] The electromagnetic-shielding film of this invention has the skeletal structure which consisted of fine particles of the conductive matter, and is characterized by the bird clapper from the fine-particles compression layer with which the resin was filled up into a part of the opening [at least], and the resin layer of this fine-particles compression layer bottom. Hereafter, the composition of this invention is explained.

[0012] In this invention, thermoplastics, such as thermosetting resin, such as melamine resin, an epoxy resin, phenol resin, a furan resin, a urethane resin, an unsaturated polyester resin, polyimide resin, and a urea-resin, acrylic resin, polyester, polyethylene, a polyethylene terephthalate, polypropylene, a polyvinyl chloride, polyvinyl alcohol, nylon, polystyrene, and polyvinyl acetate, a cellulosic, etc. can be used as a resin. Moreover, a liquefied prepolymer or a monomer and the organic binder generally used for powder molding, for example, paraffin, camphor, etc. can be used. Moreover, natural products, such as gelatin, glue, and a Rhus verniciflua, can be used as a resin. Inorganic adhesion matter, such as a silicate which furthermore changes to a resin or is represented with water glass with a resin, can also be used. Moreover, matter, such as a pigment, may be blended with the grade which cannot prevent the role of the resin in the inside of a coat.

[0013] or [whose a resin is the constituent of a resin layer / both sinking into a part of gap of the skeleton of a fine-particles compression layer] -- or it fills up Next, the fine-particles matter is a constituent of a fine-particles compression layer, if it has conductivity or conductivity, and ferromagnetism required for electromagnetic shielding, anything, is good and can use almost all metals or the end of an alloy powder. If an example is given, it will be in the end of an alloy powder powder, such as aluminum, Cu, Mg, Fe, Cr, Co, nickel, Zn, Pb, Sn, Rh, Zr, Pd, Pt, Ag, Au, Mo, and W, and they are made into a principal component. Conductivity and ferromagnetism are combined and magnetic-shielding nature is also good the alloy-powder end of Fe, nickel, and Co system. A Fe-nickel alloy, a Sendust, etc. which are represented by especially the permalloy are high permeability, and are effective in interception of a low frequency electromagnetic wave. When using without a protection coat the coat constituted with these powder, it is desirable to use a metal excellent in corrosion resistance, such as Ag and other noble metals. In this case, if an example is given, it is still more desirable to use the Cu-Ag fine particles which covered the front face of Cu fine particles with Ag (coating). Moreover, when using a metal and an alloy-powder object, it is desirable to use the fine-particles matter after coping with the surface coating processing by the scaling coat removal processing by the hydrogen reduction method etc., the coupling agent, various organic one, a mineral matter, etc. preferably. It is also desirable to perform the process which furthermore creates a fine-particles compression layer by inert gas atmosphere-ization (nitrogen gas etc.).

[0014] These powder can compound and use two or more sorts. Moreover, the end of a composite powder the particle consists of two or more sorts of material can be used. Furthermore, the fine-particles matter can use the fine particles of non-conducting below for the 40 volume % because of the improvement in a fine sight, grant of other performances, or low-cost-izing. What also has the noncrystalline thing of a crystalline substance, or whichever is sufficient the end of a metal alloy powder. In order to intercept especially the electromagnetic wave of low frequency, the quality of the material with high permeability is effective, and amorphous magnetism powder, such as a Fe-nickel alloy, can demonstrate the performance which was very excellent.

[0015] the grain size of the fine-particles matter -- processed -- it changes according to the size of a member, the thickness of a coat, and the quality of the material of the fine-particles matter Generally it is that it is desirable for grain size to be small in the case of the fine particles which cannot deform easily due to hard [, such as conductive ceramic fine particles,], and it is easy more greatly [in the case of the metal powder which is rich in ductility] than this. 0.01 to 500 micrometer Within the limits is desirable. more -- desirable -- 0.01-300 micrometers it is . It is to a pan. 0.01 to 100 micrometer It is within the limits.

[0016] Coat structure is explained following explanation of the constituent of the coat concerning this invention. The skeleton (skeleton-skeleton) is made from the fine-particles compression layer like the green compact in powder-metallurgy processing with which the particle of fine particles carried out field contact, and was connected in three dimensions. By the skeleton, the ductility of a fine-particles particle is compressed maintaining the particle shape at the time of manufacture mostly at the time of a low, as for fine particles, and on the other hand, when ductility is high, fine particles are compressed so that it deforms in the shape of a piece and a wafer is accumulated. A minute opening exists in the gap of a particle or a wafer. or [that there were very few these openings compared with the volume rate of a particle, and the opening was filled up with the resin, and space is lost] -- or it sinks in and the non-sinking in section serves as space Although space may remain, there is very little the volume compared with a skeleton, and there is little influence affect intensity etc. practically. For this reason, in the resin paint film by the conventional conductive coating material etc., the fine-particles compression layer which exists in the coat of this invention contains the fine particles of the high volume rate which has not been realized, and can obtain a near high electromagnetic-shielding performance on a par with plating or a vacuum evaporationo film.

[0017] Although bonding strength has generated the contact surface of fine-particles particles with the pressure welding by plastic deformation, frictional force, etc. like the green compact of powder-metallurgy processing, the weldbonding force by melting or big thermal diffusion is not produced. However, especially in the case of the metal powder of elastic or the low melting point, some thermal diffusion happens. This bonding strength defines the mechanical property of a skeleton mostly. When the mechanical property of the conventional conductive resin paint film has few conductive fillers, it becomes a cause for it to be set with a resin, and for fine particles to hardly, make a skeleton, but to distribute and that there are few amounts, and there is little influence to the mechanical property of a resin paint film. Moreover, by the common resin paint film, when the rate of volume of a filler becomes high, the distribution of a filler is uneven, the difference of roughness and fineness becomes large, and the cluster-like aggregate may be formed. Such the aggregate does not have strong bonding strength to the forge fire which makes said skeletal structure, and in order that a resin may not spread round the interior of the aggregate enough, the aggregate tends to collapse very easily. Therefore, since the number of such the aggregates in a coat increases so that a filler ratio becomes high, there is a fault that a membranous mechanical property, especially abrasion resistance fall. Moreover, the ratio of a resin not only decreases, but since it becomes uneven [the distribution], the membranous adhesion force declines quickly. If some of filler particles and films are omitted and it falls to the circuit section when making a coat form especially in a case inside, it will become the cause of troubles, such as a circuit short circuit.

[0018] On the other hand, although its rate of a compounding ratio of the fine-particles matter is high since there are little roughness and fineness of a particle distribution, and the skeleton of this invention does not have a fragile site like the aforementioned aggregate, it becomes what a film becomes homogeneous and has the outstanding mechanical property, and abrasion resistance and its adhesion especially improve. The opening section which exists in a skeleton is an open pore to which many have opening in a coat front face, and the resin in a coat is connected with the resin layer through this open pore. Consequently, in a fine-particles compression layer, the resin in an opening acts like a long pin or a bolt, and a powerful fixed effect is demonstrated. And since the resin in an opening is not a straight line-like and has wound, a fixed effect is heightened by this. Therefore, a coat with far high adhesion is obtained compared with said conductive resin coat and plating coat, and troubles, such as film peeling, hardly arise, either.

[0019] The resin with which the opening section of a skeletal structure was sunk in or filled up reinforces a skeletal structure besides the role which heightens the adhesion force with a resin layer, and has the role which raises the intensity of a fine-particles compression layer. Since fine particles are combined also with the resin which is combined by the bonding strength of a skeletal structure and exists in the opening of a skeletal structure again, defluxion of fine particles hardly takes place like a paint film with many fillers.

[0020] the continuation to which the opening of the skeleton structure of this invention is well-informed about the superficies of a coat -- when it is necessary to fill up the opening section with a resin, a resin can be made to permeate from the exterior of a coat, since it is a hole Furthermore, an anchor effect with a resin layer can be demonstrated using this opening, and firm coat adhesive strength can be made.

[0021] Although especially fine-particles compression layer thickness is not limited but it is necessary to choose it suitably with the size and the performance demanded of parts, 500 micrometers usually becomes an upper limit, the fine-particles compression layer exceeding this does not have an advantage accompanying thickness increase, and it causes cost quantity etc. As for thickness, it is desirable that it is 100 micrometers or less, and it is 50 micrometers or less more desirably.
[0022] Since the opening rate in a skeleton increases that the rate of a volume ratio of the fine-particles matter in a fine-particles compression layer is 40% or less and field contact of a fine-particles particle decreases, performances, such as sufficient anti-corrosiveness, are no longer obtained. The more desirable range is 50% or more, and the still more desirable range is 60% or more. It is 70% or more most desirably.
[0023] Setting to this invention, an opening has a role of a place made to sink in or fill up with a resin. Therefore, also as for some, it is good for the resin to exist in the opening of a skeleton and to fill up with the resin completely preferably.
[0024] Although it may contain the transition layer whose amount of the fine-particles matter decreases gradually toward the lower part in the upper part and may contain the fine-particles matter in the amount grade of the pigment of the usual paint film, a fine-particles compression layer and the resin layer which intervenes among parts make a resin a subject, and the whole surface is covered mostly and it has the whole surface of parts, or the role which pastes up a fine-particles compression layer on a bill-of-materials side. a fine-particles compression layer and a member -- the resin layer which intervenes between front faces -- a member -- the layer in which entered into the detailed irregularity and the adhesion force with parts was excellent with a fixed effect (anchoring effect) and adhesion is made from a front-face side In the fine-particles compression layer side of a resin layer, a resin sinks in into the opening of the skeleton of the fine-particles matter, and a fine-particles compression layer pastes parts by the adhesion and the fixed effect of a resin. The thickness of a resin layer is usually 0.1-20 micrometers, and under at this minimum, if the above-mentioned operation is not fully demonstrated but exceeds 20 micrometers on the other hand, the thickness of the whole coat will increase and it will produce the same problem as a fine-particles condensation layer. Moreover, sufficient adhesion force is no longer obtained with it being 0.5 micrometers or less. The more desirable range is 1.0 micrometers or more 10 micrometers or less, and is 1.0 micrometers or more 5 micrometers or less still more desirably.
[0025] Each above-mentioned thickness may take locally the desirable value which exists out of range that what is necessary is just to fill the requirement with the average. However, the range of the dispersion has a small desirable thing, as long as it can do [layer / fine-particles condensation] from the point of the adhesion force about the point of anti-corrosiveness and a dimensional accuracy to a resin layer. so that there are few amounts of the fine-particles matter in a resin layer -- fine particles and a member -- in order that between direct contact may decrease, the adhesion force improves more
[0026] The coat concerning this invention can be made to form more than a bilayer, and the coat more than the bilayer from which the kind of fine particles and/or resin differs in this case may be formed. When the number of layers of a coat increases, since it is uneconomical, the whole number of layers has three or less layers desirable [thickness's becoming large too much and a process become long, and].
[0027] Since a fine-particles particle distributes or the difference of roughness and fineness serves as a large cluster, although a fine-particles particle condenses and combines the coat of this invention in the conventional painting method, it is formed by the method of adjusting the membrane formation force at the time of fine-particles coat formation to the grade used as a continuum. The processed member for which these people applied as the one method by Japanese Patent Application No. No. (henceforth "point **") 224782 [three to] on August 9, Heisei 3, The resin of the coat morphosis which is in the state where it does not harden, partially in the first stage at least (a processed member may be covered beforehand), There are fine-particles matter and a way a size is substantially smaller than the aforementioned processed member, and a size adds vibration or stirring to a large coat formation medium within a container substantially rather than the aforementioned fine-particles matter.
[0028] a member -- a resin coat may be beforehand formed in a front face, and the coat may enforce the method except the resin in the above-mentioned method or the above-mentioned method in the state where it does not harden
[0029] if a resin, the fine-particles matter, and a processed member are vibrated or stirred within a container with a coat formation medium -- processed -- a member -- the layer of a resin is first formed in a front face the case where the thickness of this resin layer changes by the injection sequence of the fine-particles matter, a resin, a coat formation medium, and processed parts, or the mixed method, for example, an injection of a resin and the fine-particles matter is performed simultaneously -- a member -- a front face, a resin, and a member -- since contact of a front face and a fine-particles particle takes place simultaneously -- a member -- the resin formed in a front face -- an independent layer

becomes very thin or a bird clapper is in detection difficulty in Resin coat formation is followed, and the fine-particles matter is caught and fixed by the resin layer with the adhesion of a resin layer. the same -- a resin layer -- processed -- a member -- when hardening on a front face, the fine-particles matter is caught and hardened The coat formation medium which has received vibration or stirring gives striking power to the fine-particles matter which has received vibration or stirring similarly, and a fine-particles compression layer is made.

[0030] Although a coat formation medium generates striking power and formation of a coat is carried, it does not become the component of a coat substantially in itself. A larger coat formation medium than a processed member cannot generate uniform striking power on the former front face, and if smaller than powder, a coat formation medium will be caught in a coat. However, as long as it is 70% or less of range in the range which is not, for example, a volume ratio, the bigger medium than a processed member may be contained. Moreover, when the direction on which striking power is centralized to some extent uses a spherical medium since pressing [of fine particles] fit advances well for example, the diameter of 1mm or more is more desirably desirable 0.5mm or more, and when it is other configurations, it applies to this. moreover, the time of replacing each of media with the ball of this volume, when smaller than a processed member -- the diameter -- processed -- it says that it is smaller than the greatest thing among the diameters of a member Moreover, if requirements are filled with the average size to powder, desired striking power can be made. That is, if the former is larger than the latter with an average size in a part of particle used as a coat formation medium being finer than the fine-particles matter, desired striking power can be made. However, it is desirable for a medium finer than these fine-particles matter to have a possibility that it may be crowded for the inside of a coat, and not to be contained as much as possible.

[0031] The quality of the material of a coat formation medium needs to be satisfying the following requirements.

** There needs to be no big configuration change which observes a coat formation medium before and after coat formation by plastic deformation, and is accepted with the naked eye, and elastic deformation should not become extremely large in the coat morphosis. Therefore, soft rubber etc. does not satisfy this requirement.

** It is divided and there are not a chip, rapid wear, etc. (there may be some wear by long-term use).

If the coat formation medium of the quality of the material which does not satisfy these requirements causes plastic deformation by the collision with processed material or causes extremely big elastic deformation like soft rubber, the blow dealt to the latter will be insufficient and desired coat formation will not take place. Moreover, if it is divided and a chip and rapid wear take place, the useful life longevity of a medium becomes short and is uneconomical.

[0032] The fine-particles matter must be smaller than a coat formation medium, in order to be incorporated in a coat. The grain size of the fine-particles matter changes according to the size of processed parts, the thickness of a coat, and the quality of the material of the fine-particles matter. Generally it is within the limits of 0.01-500 micrometers. 0.01-300 micrometers is within the limits of 0.01-100 micrometers more desirably. Generally, fine particles are easy to be caught with a resin, so that grain size is small. Moreover, it is tended to push in the particle with a small grain size a blow between the particles of the fine-particles matter currently distributed on a resin coat, and sticking by pressure and combination with the fine-particles comrade or processed material by plastic deformation tend to take place. Therefore, striking power is so small that the grain size of the fine-particles matter is small, and it ends, and the surface roughness of a coat also becomes small.

[0033] A coat formation medium can use a rigid plastic etc. for products made from ceramics, such as iron, carbon steel, other alloy steel, copper and a copper alloy, aluminum and an aluminium alloy, other various metals, the product made from an alloy or aluminum 2O3, SiO2, TiO2, ZrO2, and SiC, and a glass pan. Moreover, hard rubber can also be used if sufficient striking power for coat fabrication is applied. It is necessary to choose suitably the size of these media, and the quality of the material according to the quality of the material of the configuration of parts and size, and the fine particles to be used. Moreover, two or more sizes and the medium of the quality of the material can also be mixed and used. Moreover, they also use depending on the case, being able to give surface treatment by the metal, the resin, etc., and surface coating. Moreover, you may use the compound medium constituted by two or more above-mentioned material. Moreover, since relief and equalization of striking power are performed and the homogeneity of a coat and dispersion of thickness are suppressed, elastic media, such as wood flour, and soft rubber, flexible plastics, may be suitably mixed in 50% or less of range of a volume ratio to the aforementioned medium. Since these hardly produce striking power if they are independent, they are surely used together with the aforementioned coat formation medium.

[0034] Although the configuration of a coat formation medium has a desirable spherical, an ellipse form, a cube, the triangle pole, a pillar, a cone, a triangular pyramid, a square drill, a rhombohedron, an unfixed form, and other various configurations can be used for it. The rate of each component (element) of coat formation mixture determines that it

does not incline toward one of elements, but the whole balances so that an operation of a request of each component may be demonstrated. The amount of fine particles and a resin becomes settled by the sum total of the thickness of the coat given to parts, and the surface area of parts. However, as for the ratio of a resin and fine particles, it is desirable to convert into the volume after hardening of a resin and to set up a pitch to 0.5% or more. Adhering to the parts of fine particles becomes being less than [this] inadequate. moreover, the mixing ratio of a medium and parts -- although it changes with configurations of parts, if a medium is not blended 20% or more by the apparent-volume ratio at least, it is difficult for a rate for uniform and sufficient blow to a bill-of-materials side not to be performed, but to obtain a good coat

[0035] When vibration or stirring within a container has goods or a comparatively small member, it can carry out by various methods which are described below. the arm 3 (refer to drawing 1) which was prepared in the container 2 and fixed to the axis of rotation 4, and the wing 5 (refer to drawing 2) which fixed to the axis of rotation 4 -- or although not illustrated, it is accomplished by agitators, such as an impeller and a blade In addition, ten in drawing is coat formation mixture. Moreover, as shown in drawing 3 , you may rotate the drum or pot-like container itself on a roller 6. As furthermore shown in drawing 4 , you may rotate the drum-like container 2 which fixed to the axis of rotation. Whether the upper part is released or the container is sealed, whichever is sufficient as it. In addition, as shown in drawing 5 , you may shake a container 2. You may agitate during rocking. Moreover, the powder mixture 10 may be put in in the container 2 attached at the nose of cam of the arm 7 which fixed symmetrically to the axis of rotation 4 shown in drawing 6 , and powder mixture may be mixed with a centrifugal force. It is desirable to make a container 2 rotate at this time. As long as operation of a container is the same, a rotational mechanism may use the electrode holder of not only this but the shape for example, of a disk.

[0036] Or you may add vibration to coat formation mixture with the shaker 8 prepared in a container 2 and out of the container (refer to drawing 7). The size of the force (exciting force) which takes an example to the method of adding vibration below, and is applied to coat formation mixture is explained. The value (henceforth "excitation ratio"- dimensionless number -) which averaged exciting force by the gravity (henceforth "oscillating gravity") of a container and coat formation mixture becomes the index of the impulse force which a coat formation medium applies to processed parts. As an example, when it is weight-1kgf of a 2.8l. container, weight-10kgf of a steel ball (coat formation medium), and weight-1kgf of processed parts, oscillating gravity serves as 12kgf(s). At this time, the exciting force with the desirable period of 40Hz is 20-50kgf. Therefore, an excitation ratio is set to 1.67 (=20/12)-4.17 (50/12).

[0037] When using a larger container and it is weight-4.5kgf of a 20l. container, weight-70kgf of a steel ball (coat formation medium), and weight-5.5kgf of processed parts as an example, oscillating gravity serves as 80kgf(s). At this time, the exciting force with the desirable period of 25Hz is 150kgf(s). Therefore, exciting force-ed is 150 / 80= 1.88. The goods or the member which gives electromagnetic shielding needs to set the upper limit of an excitation ratio to the grade which is not destroyed or damaged. For example, in the case of a plastics case etc., setting or less to five is desirable. Moreover, as for especially the minimum of an excitation ratio, it is [one or more] desirable that it is 1.5 or more. If an excitation ratio is smaller than this minimum, a coat growth rate will become slow. Although especially the frequency of vibration is not limited, it is desirable that it is the range of 2Hz - 200Hz. An amplitude at this time goes into the range of the above-mentioned exciting force-ed by 0.5-10mm.

[0038] Then, in the case of a churning method, it is desirable for the centrifugal force generated by rotation to be contained in the range of the above-mentioned excitation ratio to the sum total weight of coat formation mixture and a container. However, if a rotational frequency is too large and the volume rate of the coat formation mixture in/or a container is too large, coat formation mixture will be forced on a vessel wall, and mixture will not fully take place. Therefore, as for 150 or less rpm and/, or the aforementioned volume rate, it is [a rotational frequency] desirable to fulfill 80% or less of conditions.

[0039] When performing covering of a on the other hand comparatively big member or a plate, as shown in drawing 8 , a container 1 may be divided with the partition board 30, parts 33 may be thrown into each of the divided partition 31, and a container may be vibrated. Moreover, as shown in drawing 9 , you may hang parts 33 in a container 1 with fishing tackle 36.

[0040] If a wire gauze is used instead of the partition board 30 by drawing 8 , since a coat formation medium passes through the mesh of a wire gauze and can go the inside of a tub back and forth freely, fine particles can spread uniformly and a uniform and good coat can be obtained. Moreover, as shown in drawing 10 , a member 33 is fixed in a container 1, a container is excited, and/or a member 33 may be connected to a shaker 8 and a member 33 may be made to excite. As are shown in drawing 11 , and a member 33 is hung and a medium contacts only one side of a member 33, if a container is vibrated, only one side of a member can be covered.

[0041] When a member is a plastics case, a solvent is applied instead of a resin, and it is begun to melt the plastics of a member, and is good also as a resin layer. According to this method, since a coat is formed only in the portion to which the resin or the solvent was applied, it can carry out very easily [making a coat form only in a case inside etc.]. When making an electromagnetic-shielding film form in goods by the above-mentioned method, at once, the desired whole front face may be unable to be covered. In such a case, after dividing goods into the member of once some and making a film form in a respectively required portion, the method of assembling is effective. Moreover, it can cover by enclosing the room with the board which made the electromagnetic-shielding film form in one side or both sides by the above-mentioned method to carry out electromagnetic shielding of the big space, such as an anechoic chamber.
[0042] a simple board -- or in order to make a coat form in a long and slender wire rod, as it is shown in drawing 12 , a hole 28 is made in the bottom of a container 1, the members 3, such as a board, are put in here and through and the coat formation medium 7 are put in to a container 1 A resin and fine particles are supplied little by little continuously, adding vibration to a container, and it draws out downward, sliding a member 33 to packing 39. Before going into a container 1, a resin layer may be beforehand attached to the front face of a member 33, this may be drawn in a container 1, and only fine particles may be supplied into a container 1. The member of a tabular can be brought near by one side of a container like drawing 12 , and a film can be made to form only in one side of a board. A member 33 is horizontally drawn out like drawing 13 , and you may make it form a coat in both sides.
[0043] It may be difficult to form a coat in the corner of a case depending on the method explained with reference to drawing 1 -13. In this case, make a non-hardened resin and other adhesive material adhere to the front face of coat formation media, such as a shot 42, beforehand, and fine particles 41 are made to adhere there, and this shot 42 is made to blow off from a nozzle 45, as shown in drawing 14 . The case 40 forms the non-hardened resin layer 43 beforehand. If a shot 42 collides with the resin layer 43, fine particles 41 will be caught and stuffed into the resin layer 43. Since it falls and the collision of a shot 42 takes place one after another, fine particles are increasingly pushed in in the resin layer 43, and are compressed, density increases, field contact is carried out and the shot 42 which fine particles 41 left makes a skeletal structure. Apart from the above-mentioned method, you may inject fine particles 41 and a shot 42 toward the same part separately. Injection of a shot 42 may use a gas stream and may inject it mechanically. Moreover, in order to make a fine-particles compression layer form especially in a corner, beveling to a corner (corner ****) is desirable. Although beveling is generally expressed with the radius of curvature R, it is desirable to carry out R= 0.5-2mm corner **** still more preferably R= 0.25-3mm more preferably [it is desirable and] than R= 0.1-5mm.
[0044] Since the intensity of the whole coat and corrosion resistance are raised, it is possible to cover the electromagnetic-shielding film of this invention by the plating protective coat for defluxion prevention of a part of fine particles or coat. This plating coat can be made to form by the electrolysis galvanizing method by [of an electromagnetic-shielding film] constituting the best layer from a fine-particles compression layer of a metal or an alloy at least at this time. On the other hand, conventionally, although all the cover films by the plating to a plastics case front face etc. were made by electroless plating, according to this invention, they can produce this with electrolysis plating.
[0045] A protective film can use the resin of a coat, a homotypic, or a resin of a different kind as a film. As for the thickness of a resin paint film, it is desirable that it is [0.5 micrometer or more] 300 micrometers or less. Moreover, vinyl etc. can also be covered instead of a paint film.
[0046] in order to carry out electric grounding of the electromagnetic-shielding film which prepared the resin protective film -- a protective film -- exposure -- the need of opening a hole comes out In order to avoid this, let the resin of a protective film be conductive coating material or a conductive organic material. As a material which can be used for this, there is conductive coating material containing conductor fine particles, such as the conductive poly aniline, a doped type polyacethylene, nickel, Cu and Ag, Cu-Ag (Ag plating Cu powder), and nickel-Ag (Ag plating nickel powder), etc.
[0047]
[Function] The above is collectively explained about the property of the electromagnetic-shielding film of this invention.
(b) Lightweight nature : since it is a coat, there are few weights.
(b) Shield performance : since it is a skeletal structure and contents, such as a metal, are made more highly than the conventional conductive paint, the shield performance is excellent.
(c) Waste fluid processing : since it is based on a dry process, the waste fluid processing of a skeletal structure is unnecessary.
(d) Preliminary processing : although a resin layer may be formed as preliminary processing, compared with

preliminary processing of electroless plating, it is easy.
(e) Since a coat sticks and a sex:skeletal structure grows in three dimensions the surroundings, coat growth does not take place in the specific direction like PVD. Therefore, it attaches and surroundings nature is good.
(**) Appearance : the paint film and appearance of a resin are equivalent and good.
An example explains this invention in detail below.
[0048]
[Example] 10kg of steel balls with a diameter of 1mm which carried out nickel plating on the front face was thrown in in the circular pot with a capacity [example 1 / of 2.8l.], and a depth of 150mm, and 30 cc of MEK solutions which melted 10% (97% of resins, 3% of curing agents) of epoxy resins from on the was sprinkled. Vibration (the vibration frequency of 3600cpm, amplitude of 0.5-2mm) was added to the container for 10 minutes, and the resin was uniformly spread round the steel ball front face. Then, 25g of Ag powder with a particle size of 0.1-1 micrometer was thrown in, and the same vibration was added for 10 minutes.
[0049] next, the front face of an up opening case-like member (resin made from a PC/ABS alloy) with width of face of 70mm, a depth [of 49mm], and a depth of 10mm -- an epoxy resin (what diluted 94% of epoxy resins, and 6% of curing agents with MEK to concentration 10%) -- a spray application -- carrying out -- a member -- the pot after creating a resin layer to an internal surface -- supplying -- the same vibration -- for 20 minutes -- adding -- a member -- Ag coat The posterior part material was taken out, it put in into the pot (10kg of shots with a diameter of 2mm which carried out nickel plating is put into the front face in inside) prepared independently, and 5,000cpm and vibration with an amplitude of 0.2-1mm were added for 10 minutes, and while removing excessive Ag powder adhering to the front face, processing which makes a higher-density and uniform film was performed. The posterior part material was taken out and hardening processing was carried out at 60 degrees C for 2 hours. Consequently, the uniform film of 14 micrometers of average thickness has been formed in the inside of a member. Although the surface-electrical-resistance values within each side were below 0.1ohms / **, the resistance between each field was 0.2ohm/**-0.5ohm/**.
[0050] The electron microscope photograph of the coat created by this example is shown in drawing 16 (one 2000 times the scale factor of this). A resin layer with a thickness of about 1 micrometer is on the surface of a member, and about 14-micrometer Ag layer which had skeleton structure on it exists. The rate of a volume ratio of Ag in Ag layer was 60% or more. Moreover, when the scale factor was expanded by 10,000 times, it has checked that the resin sank in toward the opening of skeleton structure from the resin layer of the skeleton layer lower part.
[0051] Moreover, as a result of painting 14micro of nickel system (nickel powder-1 liquid type acrylic resin-thinner 30%) conductive coating material by spray painting as an example of comparison to the same member (what nothing is processing) inside, the resistance between the fields within each field was 1.2ohm/**-3.0ohm/**, and since it was resistance 0.5ohms / more than **, the EMI shield found that it was unsuitable. The rate of a volume ratio of nickel in this electric conduction film was 25% or less. Moreover, when thickness of nickel electric conduction film was set to 50 micrometers, the resistance between the fields within each side became 0.3ohm/** - 0.5ohms / **.
[0052] the member shown in example 2 drawing 15 -- when the member made from PPE (polyphenylene ether) which gave R= 0.5mm R **** to the boundary section of each side of 50 inside was used and processing by the same this invention as an example 1 was performed, uniform Ag coat of 4micro of average thickness could be formed, and the surface-electrical-resistance values within each field and between a field were below 0.1ohms / ** In addition, 51 is a hole containing the key of a keyboard etc.
[0053] It took out, after soaking the member created in the example 3 example 1 into an epoxy resin solution (what diluted 92% of epoxy resins, and 8% of curing agents with the acetone to concentration 5%), and 4-hour dryness and hardening of were done at 60 degrees C. Consequently, an average of 5micro epoxy resin coat has created on Ag coat on the film created in the example 1. then -- although ablation was slightly accepted from the coat of the member created in the example 1 when the tape friction test was performed -- this example -- from the coat front face of a member, ablation was not accepted at all
[0054] moreover, the member similarly created in the example 1 -- when the epoxy resin solution (what diluted 96% of epoxy resins and 4% of curing agents with toluene to concentration 3%) was sprayed inside and it was dried at 80 degrees C for 1 hour, the uniform epoxy resin coat whose average thickness is 3micro has created on Ag coat Moreover, ablation according from the coat front face of this member to a tape examination was not accepted at all.
[0055] the member created in the example 4 example 1 -- spray coating of the Cu system conductive paint (Sumitomo 3M electromagnetism guard spray) was carried out at the inside As a result of making it dry after that, Cu system conductivity film of 8 micrometers of average thickness was obtained on Ag coat. a member -- when resistance within the field of an inside and between a field was measured, all were below 0.1ohms / ** Moreover, ablation by the tape

friction test was not accepted at all, either.
[0056] moreover, the member created in the example 1 -- the fusibility poly aniline system conductive polymer was dried for 5 minutes at 60 degrees C after spray painting to the internal surface Consequently, the conductive poly ANIN film of 5micro of average thickness has formed on Ag coat. a member -- when the resistance within the field of an inside and between a field was measured, all were below 0.1ohms / ** Furthermore, ablation according from the coat front face of this member to a tape examination was not accepted at all.
[0057] 10kg of steel balls with a diameter of 3mm which carried out chrome plating on the front face was thrown in in the circular pot with a capacity [example 5 / of 2.8l.], and a depth of 150mm, and 20 cc of MEK solutions which melted 15% (97% of resins, 3% of curing agents) of epoxy resins on it was sprinkled over the steel ball front face. Vibration (the vibration frequency of 3600cpm, amplitude of 0.5-3mm) was added to the container for 5 minutes, and the resin was uniformly spread round the steel ball front face. Then, 30g (what carried out Ag plating on the front face of Cu powder) of Ag-Cu powder of 3.5micro of mean particle diameters was thrown in, and the same vibration was added for 1 hour.
[0058] next, the internal surface of the member (R= 1.5mm beveling has been performed to the boundary section of each field which masking is not carrying out on the resin made from ABS, and superficies) of the size shown in drawing 15 -- an epoxy resin (what diluted 94% of epoxy resins, and 6% of curing agents with MEK to concentration 10%) -- a spray application -- carrying out -- a member -- after forming a resin layer in an internal surface, it supplied to the pot and the same vibration was added for 20 minutes The posterior part material was taken out, it put into the pot (10kg of shots with a diameter of 0.5mm which carried out nickel plating is put into the front face in inside) prepared independently, and 5,400cpm and vibration with an amplitude of 0.1-2mm were added for 10 minutes, and while removing the excessive Ag-Cu powder adhering to the front face, processing which makes a higher-density and uniform film was performed. The posterior part material was taken out and hardening processing was carried out at 60 degrees C for 2 hours. Consequently, the uniform film of 8micro of average thickness has been formed in the inside of a member. The surface-electrical-resistance values within each side were below 0.1ohms / **, and the resistance between each side was 0.1ohms / below **-0.2ohm/**.
[0059] 10kg of steel balls with a diameter of 1-3mm which carried out nickel plating on the front face was thrown in in the circular pot with a capacity [example 6 / of 2.8l.], and a depth of 150mm, and 20 cc of MEK solutions which melted 15% (97% of resins, 3% of curing agents) of epoxy resins on it was sprinkled over the steel ball front face. Vibration (the vibration frequency of 3600cpm, amplitude of 0.2-1mm) was added to the container for 10 minutes, and the resin was uniformly spread round the steel ball front face. Then, 20g of Cu powder of 5 micrometers of mean particle diameters was thrown in, and the same vibration was added for 1 hour.
[0060] next, the internal surface of the member of an example 1 -- an epoxy resin (what diluted 94% of epoxy resins, and 6% of curing agents with MEK to concentration 10%) -- a spray application -- carrying out -- a member -- after forming a resin layer in an internal surface, it supplied to the pot and the same vibration was added for 20 minutes Posterior part material was taken out for 20 minutes, and hardening processing was carried out at 60 degrees C for 2 hours. Next, it put in into the pot (10kg of shots with a diameter of 1mm which carried out nickel plating is put into the front face in inside) prepared independently, and 3,600cpm and vibration with an amplitude of 0.5-1mm were added for 10 minutes, and while removing excessive Cu powder adhering to the front face, processing which makes a higher-density and uniform film was performed. Consequently, Cu film of 4micro of average thickness was obtained, and the resistance within each field was 1ohm/**-20ohm/**.
[0061] The process which adds example 7 vibration was processed in inert gas (nitrogen gas of 98% of purity) atmosphere, and also the same processing as an example 6 was performed. Consequently, Cu film of 8micro of average thickness was obtained, and the resistance within each field was below 0.2ohm/** - 0.1ohms / **.
[0062] Using the powder immediately after hydrogen-reduction processing (what carried out style mind reduction for 6 hours in 400 degrees C - 600 degrees C high grade hydrogen gas atmosphere), others carried out membrane formation processing of the example 8Cu powder at the same process as an example 6. Consequently, Cu film of 10micro of average thickness was obtained, and the resistance within each field was 0.5-0.2ohm/**.
[0063] 2kg of ceramic balls with a diameter of 0.5mm which carried out nickel plating to the front face was thrown in in the circular pot with a capacity [example 9 / of 2.8l.], and a depth of 150mm, and 30 cc of MEK solutions which melted 10% (97% of resins, 3% of curing agents) of epoxy resins on it was sprinkled. Vibration (the vibration frequency of 3600cpm, amplitude of 0.5-2mm) was added to the container for 10 minutes, and the resin was uniformly spread round the ceramic ball front face. Then, 25g (what carried out Ag plating processing on the front face of nickel powder) of Ag-nickel powder of 1 micrometer of mean particle diameters was thrown in, and the same vibration was

added for 20 minutes. Then, the member 50 (masking is not carrying out on the resin made from ABS, and superficies.) of the size which fed into shot-blasting equipment the ceramic ball which the Ag-nickel powder after the above-mentioned processing attached to the front face, and was shown in drawing 17 on the conditions of 10-60cm of pressure 4 kg/cm2 distance Spray painting of the epoxy resin is carried out to the inside. Spray processing was performed for 10 minutes. Hardening processing was performed at 60 degrees C after that for 4 hours. Consequently, 4 micrometers of average thickness and the uniform electric conduction film below each field internal-resistance value of 0.3-0.1ohms / ** were made. moreover, after that -- further -- a member -- when the electrolysis nickel plating film of an average of 1micro thickness was formed to the internal surface, each field internal resistance became below 0.1ohms / ** In addition, in drawing 17 , 52 is a slit for thermolysis.

[0064]

[Effect of the Invention] As this invention was explained above, it attaches, and surroundings nature is good and a lightweight nature and shield performance and the trouble derived to coat formation can also form a coat easily few.

[Translation done.]